Inert dusts
Better alternatives to manage Angoumois grain moth, *Sitotroga cerealella* in stored rice

Dr. M.Rajasri
Scientist (Seed Entomology)
Seed Research & Technology Centre
A.N.G.Ranga Agricultural University
Hyderabad-500030,
Andhra Pradesh, India
India is the world's second largest producer of rice, accounting for 20% of world’s rice production.

Rice is the staple food of 65% of the total population of India.

Constitutes about 52% of total food grain production and 55% of total cereal production.

Post harvest losses - $16,000 million every year (Microfinance India on July 29, 2009).


Food grains wasted during post-harvest period can feed 117 million people / year
Post harvest losses in India

- Post harvest losses in India 10%
- Storage losses – 6.58 %
- In India - annual storage losses – 14 million tonnes of food grains worth $16,000 million every year.
- Loss due to insects – 300 million $.
- Post-harvest losses in India – 12 to 16 million metric ton / year could feed one-third of India's poor
Angoumois grain moth, *Sitotroga cerealella*

- *Sitotroga cerealella*, most destructive internal feeder of stored rice.
- Eggs were laid on the surface & newly hatched larvae bore into kernels through cracks on husk.
- Larval development & pupation inside the kernel.
- Adult moth emerges out through pre-pupal circular flap door.

Inert dusts - safer alternatives to synthetic chemicals, but information on their efficacy on Angoumois grain moth, *Sitotroga cerealella* was limited.
Table 1. Relationship between *Sitotroga cerealella* population and level of infestation in Paddy.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Treatment</th>
<th>No. of insects emerged</th>
<th>Damage (%)</th>
<th>(% wt. Loss)</th>
<th>Germ (%)</th>
<th>Moisture Content (%)</th>
<th>Vigour index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Zero (insect free)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>88.3</td>
<td>11.0</td>
<td>877</td>
</tr>
<tr>
<td>2.</td>
<td>One pair</td>
<td>34</td>
<td>0.8</td>
<td>1.0</td>
<td>82.6</td>
<td>11.9</td>
<td>817</td>
</tr>
<tr>
<td>3.</td>
<td>Two pairs</td>
<td>66</td>
<td>2.0</td>
<td>4.5</td>
<td>81.3</td>
<td>12.0</td>
<td>759</td>
</tr>
<tr>
<td>4.</td>
<td>Four pairs</td>
<td>86</td>
<td>2.5</td>
<td>8.8</td>
<td>79.0</td>
<td>12.1</td>
<td>700</td>
</tr>
<tr>
<td>5.</td>
<td>Eight pairs</td>
<td>167</td>
<td>3.0</td>
<td>14.2</td>
<td>71.6</td>
<td>12.5</td>
<td>564</td>
</tr>
</tbody>
</table>
# Inert dusts – Treatments

<table>
<thead>
<tr>
<th>Inert dusts</th>
<th>Treatments</th>
<th>Mode of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow dung cake ash</td>
<td>@ 2.5g/kg</td>
<td>Exert their effects on insects through physical means</td>
</tr>
<tr>
<td>Cow dung cake ash</td>
<td>@ 5g/kg</td>
<td></td>
</tr>
<tr>
<td>Rice husk ash</td>
<td>@ 2.5g/kg</td>
<td>Act as desiccating agents</td>
</tr>
<tr>
<td>Rice husk ash</td>
<td>@ 5g/kg</td>
<td></td>
</tr>
<tr>
<td>Diatomaceous earth</td>
<td>@ 2.5g/kg</td>
<td>Repellents</td>
</tr>
<tr>
<td>Diatomaceous earth</td>
<td>@ 5g/kg</td>
<td></td>
</tr>
<tr>
<td>Indispron P 406</td>
<td>@ 2.5g/kg</td>
<td></td>
</tr>
<tr>
<td><strong>Indispron P 406</strong></td>
<td><strong>@ 5g/kg</strong></td>
<td></td>
</tr>
<tr>
<td>Deltamethrin</td>
<td>@ 40mg/kg</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Methodology

Rice seed with high germinability, vigour and low seed moisture was treated with inert dusts at the test doses.

Seed stored in HDPE bags and kept under ambient conditions.

Objectives:

Effect of inert dusts on *Sitotroga cerealella* damage in stored rice.

Qualitative and quantitative losses due to storage pests of rice.

Packing material: HDPE bag of 2 kg capacity
Design: CRD
Replications: 3
Table 2: Effect of inert dusts on the germinability of paddy seed at different storage intervals.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>% Germination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 months</td>
</tr>
<tr>
<td>Cow dung cake ash @ 2.5g/kg</td>
<td>91.00</td>
</tr>
<tr>
<td>Cow dung cake ash @ 5g/kg</td>
<td>91.00</td>
</tr>
<tr>
<td>Rice husk ash @ 2.5g/kg</td>
<td>90.67</td>
</tr>
<tr>
<td>Rice husk ash @ 5g/kg</td>
<td>91.33</td>
</tr>
<tr>
<td>Diatomaceous earth @ 2.5g/kg</td>
<td>90.33</td>
</tr>
<tr>
<td>Diatomaceous earth @ 5g/kg</td>
<td>91.33</td>
</tr>
<tr>
<td>Indispron P-406 @ 2.5g/kg</td>
<td>92.00</td>
</tr>
<tr>
<td>Indispron P-406 @ 5g/kg</td>
<td>92.33</td>
</tr>
<tr>
<td>Deltamethrin @ 40 mg/kg</td>
<td>87.33</td>
</tr>
<tr>
<td>Control</td>
<td>84.67</td>
</tr>
<tr>
<td>F-Test</td>
<td>NS</td>
</tr>
<tr>
<td>CD at 5%</td>
<td>--</td>
</tr>
</tbody>
</table>
Table 3. Effect of inert dusts on the moisture content of paddy seed at different storage intervals.

<table>
<thead>
<tr>
<th>S. NO</th>
<th>Treatments</th>
<th>3 months</th>
<th>6 months</th>
<th>9 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Cowdung cake ash @ 2.5g/kg</td>
<td>9.70</td>
<td>9.83</td>
<td>12.53</td>
<td>11.07</td>
</tr>
<tr>
<td>T2</td>
<td>Cowdung cake ash @ 5g/kg</td>
<td>9.53</td>
<td>10.03</td>
<td>12.57</td>
<td>10.80</td>
</tr>
<tr>
<td>T3</td>
<td>Rice husk ash @ 2.5g/kg</td>
<td>9.70</td>
<td>10.10</td>
<td>12.57</td>
<td>10.08</td>
</tr>
<tr>
<td>T4</td>
<td>Rice husk ash @ 5g/kg</td>
<td>9.67</td>
<td>10.00</td>
<td>12.57</td>
<td>10.10</td>
</tr>
<tr>
<td>T5</td>
<td>Diatomaceous earth @ 2.5g/kg</td>
<td>9.63</td>
<td>10.17</td>
<td>12.40</td>
<td>11.17</td>
</tr>
<tr>
<td>T6</td>
<td>Diatomaceous earth @ 5g/kg</td>
<td>9.57</td>
<td>10.20</td>
<td>12.67</td>
<td>11.07</td>
</tr>
<tr>
<td>T7</td>
<td>Indispron P 406 @ 2.5g/kg</td>
<td>9.57</td>
<td>10.17</td>
<td>12.37</td>
<td>11.03</td>
</tr>
<tr>
<td>T8</td>
<td>Indispron P 406 @ 5g/kg</td>
<td>9.50</td>
<td>09.97</td>
<td>12.67</td>
<td>12.00</td>
</tr>
<tr>
<td>T9</td>
<td>Deltamethrin @ 40mg/kg</td>
<td>9.80</td>
<td>09.77</td>
<td>12.57</td>
<td>12.00</td>
</tr>
<tr>
<td>T10</td>
<td>Control</td>
<td>9.70</td>
<td>10.13</td>
<td>12.70</td>
<td>12.33</td>
</tr>
</tbody>
</table>

F-Test: NS NS NS Sig
CD at 5%: - - - 0.29
Fig 1. Effect of inert dusts on the damage caused by *Sitotroga cerealella* to paddy seed at different storage intervals.
Fig 2. Effect of inert dusts on the seedling vigour index (SVI) and % weight loss of paddy seed at different storage intervals.
Fig 3. Effect of inert dusts on germinability, insect damage and seedling vigour index of paddy seed (12 months after storage)
Inert dusts - diatomaceous earth and Indispron @ 5g/kg paddy seed effective seed dressers compared to deltamethrin.

Safe storage of rice for 12 months without any insect damage.

Safer, cheaper and eco-friendly materials with low mammalian toxicity.

Residues problem can be avoided.

High germinability and vigour of seed was maintained for 12 months.

Both quality and quantity loss was avoided due to this seed treatment

Inert dusts- Proved to be better alternatives to conventional insecticides for the safe storage of rice against storage pests.
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Friends & Colleagues………..